REMARKS

Claims 1-88 are presently in this application. Claims 1-29, 35-40, 45-73 and 79-84 are allowed. Claims 30-34, 41-42, 44, 74-78, 85-86 and 88 are rejected. Claims 43 and 87 are objected to and would be allowable if rewritten in independent form.

I. Introduction

As noted in the Examiner's comments, Cheng et al., U.S. Patent No. 6,516,274 uses the term "skeleton patch", which is a term also used in the present patent application. However, both the definition of a skeleton patch and the algorithm used to identify the skeleton patch by Cheng et al. is distinctly different from the definition and algorithm used in the present application.

The "skeleton patch" in Cheng et al. is a set of connected line segments that follows along a stratigraphic layer in the 3D seismic cube. The "skeleton patch" as used in the present invention is an agglomeration of voxels that lay along geologic faults in a 3D seismic cube, and not along a stratigraphic rock layer.

Cheng et al.'s "skeleton patch" is obtained by tracing a geologic layer laterally in a 2D cross section of the cube. The "skeleton patch" of the present invention is preferably obtained by the image processing procedure known as "skeletonization", which is distinctly different from the seismic amplitude tracking process used in Cheng et al. There is very little algorithmic similarity to Cheng et al. and the present algorithms, despite the usage of similar lexicography.

Further, Cheng et al. involves a method for dip correction and subsequent enhancement of the seismic data to create a voxel cube in which the probable location of edges or faults is made visible by enhancement.

The present invention is distinctly different. It is assumed that an enhanced edge/fault cube of seismic data already exists. The present invention takes such an enhanced edge/fault cube as input and describes a new method for automatic interpretation and extraction of geologic faults. In contrast, Cheng et al. enhances the appearance of discontinuities, as implied by the title of the patent, but does not teach the extraction of faults.

Other terms referenced, such as voxels, cubes, planes, lattice, dip volumes and intersections – all of these are common terms used in geophysical processing work. The presence of these terms in Cheng et al. and the present invention is not an indication of similarity, nor does their usage.equate to obviousness of process. The Cheng et al. and present application and each processing ideas which are quite dissimilar.

II. <u>Rejection of Claims</u>

Claims 30-34, 41-42, 44, 74-78, 85-86 and 88 are rejected under 35 U.S.C. §103(a) as being unpatentable over Cheng et al., U.S. Patent No. 6,516,274. Applicants respectfully traverse these rejections.

Claim 30 recites, in part, "a method for extracting faults", "reading a composite fault fragment into a 3-D lattice" and also "constructing a best-fit plane from adjacent connected points within the 3-D lattice." In the present invention, a fault fragment is represented by a 3D set of voxels with x, y, and z locations and the best-fit plane is constructed from adjacent connected points within the 3-D lattice.

Cheng et al. enhances the appearance of discontinuities but does not teach extracting faults. Cheng et al. compares the amplitude values of adjacent seismic traces along 2D linear cross sections of seismic data to generate a connected set of line segments that follow along a stratigraphic layer. This is a distinctly different process from that claimed in Claim 30. Seismic amplitude comparison is not involved in this part of the present invention.

Claim 31 involves determining if two 3D sets of voxels, defined by x, y, and z locations, representing fault patches, are close enough to be combined on the basis of co-planarity measured by distance and angle parameters. Seismic amplitude is not involved in this part of the present invention.

Again, Cheng et al. compares the amplitude values of adjacent seismic traces along 2D linear cross sections of seismic data to generate a connected set of line segments that follow along a stratigraphic layer. Cheng et al. does not suggest assessing the proximity of 3D sets of voxels. Cheng et al. uses a distinctly different process than that recited in Claim 31.

Claim 32 involves determining if two 3D sets of voxels, defined by x, y, and z locations, representing fault patches, are close enough to be combined on the basis of visual examination. Cheng et al. does not suggest visual assessment of the proximity of 3D sets of voxels.

Claim 33 involves determining if two 3D sets of voxels, defined by x, y, and z locations, representing fault patches, are close enough to be combined on the basis of visual examination and iterative correlation. Cheng et al. does not suggest assessing the proximity of 3D sets of voxels nor does Cheng et al. suggest visual analysis for decision making.

Claim 34 involves calculating the 3D minimum path value and extracting a 3D fault network. Cheng et al. does not calculate the 3D minimum path or extraction of a 3D fault network.

Claim 41 involves extracting the 3D faults from the 3D cube and creating a vector description of the 3D objects. Cheng et al. enhances the appearance of discontinuities rather than extracting faults. Cheng et al. does not teach a fault network. Nor does Cheng et al. teach: 1) use an adjacency list to merge fault patches fragments; 2) the labeling the fault segments; 3) creating a vector description of the fault segments. Cheng et al. compares the amplitude values of adjacent seismic traces along 2D linear cross sections of seismic data to generate a connected set of line segments that follow along a stratigraphic layer. Again, Cheng et al. does not suggest extraction of a 3D fault network or creation of a vector description of 3D objects.

Claim 42 recognizes that it is advantageous to extract discrete 3D fault objects from the 3D cube. Cheng et al. does not suggest extraction of a 3D objects.

Claim 43 includes using the eigenvector of the variance-covariance matrix to determine if a 3D fault patch should be separated into distinct 3D parts. Cheng et al. does not suggest use of eigenvectors, variance-covariance matrices, 3D fault patches nor separation of fault patches into distinct parts.

Claim 44 includes fitting a best fit plane to adjacent points of the distinct fault patches. Cheng et al. does not suggest best fit planes to 3D fault patches.

Claims 74-78 are" computer readable" versions of Claims 30-34. For the reasons recited above, Claims 74-78 are also believed to be patentable over Cheng et al.

Claims 85-86 are "computer readable" claims related to Claims 41-42. For the reasons described above with respect to Claims 41-42, Claims 85-86 are believed to be patentable over Cheng et al.

III. Allowable Subject Matter

Claims 87 and 88 are objected to as being dependent upon rejected base claims, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. However, as independent Claim 85 is believed to be patentable, these dependent claims should be allowable as well.

IV. Request for Allowance

In light of the above amendments and remarks, the Applicants respectfully request reconsideration and allowance of this application.

Respectfully submitted,

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